JOURNAL

OF THE

ELISHA MITCHELL SCIENTIFIC SOCIETY

1900

SEVENTEENTH YEAR PART FIRST

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THE LABORATORY OF THE U. S. FISH COMMISSION, AT BEAUFORT, N. C.

H. V. WILSON.

Extracted with permission from the report for 1899 of the U. S. Commissioner of Fish and Fisheries, Hon. Geo. M. Bowers.

In conjunction with the fresh-water fish-cultural operations carried on at its new station at Edenton, N. C., on Albemarle Sound, the Commission contemplates the artificial propagation of the important salt-water fishes which spawn in the coastal waters of North Carolina and other South Atlantic States. An essential preliminary to this work is the study of the habits, abundance and distribution of the food-fishes, and also the determination of the non-economic fishes and other animals which are related to the food-fishes as food, enemies, etc. After consultation with Prof. J. A. Holmes, of the North Carolina Geological and Natural History Survey, Dr. H. V. Wilson, Professor of Biology in the State University, and other

persons interested in the development of the fishery resources of the region, it was decided that the best place for the prosecution of marine fish-cultural operations and the conjoint scientific investigations was Beaufort harbor. The harbor and the adjacent waters teem with animals in great variety and abundance. Many naturalists have from time to time resorted to the region for the study of special problems, the advantages of the locality having been especially demonstrated by Professor Brooks and other members of Johns Hopkins University, who maintained a laboratory at Beaufort during a period of ten years.

The consensus of opinion was that the Beaufort region was not only favorable for the study of the comparatively local problems of the North Carolina waters, but also for the investigation of the fauna of the southeastern coast in general, from the combined economic and scientific standpoints. Accordingly, in May, 1899, the Commission announced that it would maintain, during the succeeding summer, at Beaufort, N. C., a laboratory for the study of questions pertaining to fish-culture, fisheries and marine biology, and placed Prof. H. V. Wilson in charge. Beaufort is situated on Beaufort Harbor, near one of the great ocean inlets, and is reached by boat from Morehead City, the nearest railroad terminus. The use of a commodious building on the water front was acquired at a nominal rental; a suitable equipment was provided; a small working library was installed; a steam launch was assigned from another station, and on June 1 the laboratory was opened to a limited number of investigators. By the close of the year the following persons had taken tables in the laboratory, and a number of others had applied for accommodations later in the season: Dr. D. S. Johnson, Dr. Gilman A. Drew, Dr. Caswell Grave and Mr. W. C. Coker, all of Johns Hopkins University; Prof.

J. I. Hamaker, of Trinity College, N. C.; Prof. T. G. Pearson, of Guilford College, N. C.; Prof. E. W. Berger, of Baldwin University, Ohio, and Prof. H. V. Wilson, of the University of North Carolina.

The special investigations carried on at the laboratory in June included the following: Dr. Johnson and Mr. Coker studied from a systematic and œcological standpoint the marine algæ of the harbor and the flora of the banks. Dr. Drew considered the habits of the clam (*Solenomya velum*), investigated the breeding condition of the round clams (*Venus mercenaria* and *V. elevata*) and other bivalve mollusks, and reared the eggs of *Venus elevata*. Dr. Grave studied the embryology of certain ophiurans, and made a number of valuable observations on the breeding time and general life-history of other echinoderms. Professor Wilson's work included observations on the breeding condition of the sponges and of certain edible fish. All the members of the laboratory cooperated in the effort to determine the animals and plants in and near the harbor, their abundance, local distribution, breeding times, habits, etc. The foundation of a museum collection illustrating the fauna and flora of the region was laid, and a record book was opened, in which full notes on each species observed were entered.

[Reprinted from *Science*.]

The second session of the Beaufort Laboratory of the U. S. Fish Commission came to an end September 15th, 1900. The occupants of tables were from Johns Hopkins University, Columbia University, University of North Carolina, and Trinity College (N. C.). The economic work, carried on by special assistants in the service of the Commission, embraced a study of the neighboring natural and artificial oyster beds, breeding times and food of certain food-fishes, life histories of fish (blennies), life

history of a lepadide barnacle (Dichelapsis) which has been found to be a common parasite in the gill chambers of the edible crabs, Callinectes and Menippe. The more purely scientific investigations covered a wide field, embracing such diverse subjects as the systematic zoology and ecology of actinians, echinoderms, and sponges; embryology of ophiurans; larval development of actinians; regeneration phenomena in ophiurans, and in Renilla; embryology of gephyrean worms (Thalassema); cell lineage of Axiothea; experimental work on the cleavage of the oyster egg; cytological phenomena in the "chemically fertilized" eggs of Toxopneustes.

SOME EAST AMERICAN SPECIES OF CRATAEGUS.

CONTRIBUTIONS FROM MY HERBARIUM, NO. X.*

W. W. ASHE.

CRATAEGUS RORIBACCA sp. nov. A small tree, 4-7 m. in height, with an oval crown and spreading or ascending branches, the trunk generally furrowed or fluted, its dark gray bark broken into thin scales, the bark of the branches light gray. Twigs, slender, glabrous, armed with very few 3-5 cm. long thorns. Leaves thin, flaccid, bright green, glabrous below, somewhat scabrous above, the blades broadly ovate or nearly orbicular, often isodimetric, 4-8 cm. long, 3.5-7 cm. wide, very sharply serrate except at the base, seldom doubly serrate or lobed except on vigorous shoots, and such lobes very shallow, abruptly acute at apex, rounded, truncate or subcordate at base; petiole slender, 2-3.5 cm. long. Corymbs compound, 8-20-flowered, 5-8 cm. wide, glabrous; stamens 20; fruiting pedicels 1-5, 1-4 cm. long, spreading or drooping. Fruit

*Issued Dec. 20, 1900.

globular, generally thicker than long, 11-14 mm. long, 14-17 mm. thick, dark, but bright red, or occasionally with orange-red or orange spots, flesh pale yellow; calyx lobes sessile or nearly so, the cavity 4 mm. wide; seed large, 7-8 mm. long, about 4 mm. wide, the lateral faces plane, deeply dorsaly sulcate.

I have seen this tree only on Oconaluftee river, in the mountains of North Carolina, where the type material was collected.

CRATAEGUS RUGOSA, sp. nov. A small tree, 3-4 m. in height, with an oval or flattened crown and horizontal or spreading branches and dense foliage. Twigs glabrous, slender, geniculate or flexous, armed with stout 4-6 cm. long thorns. Leaves glabrous, thin but firm, light green above, yellowish beneath, the blades broadly ovate or deltoid, often isodimetric, obtuse or truncate at base and generally shallow-lobed, much wrinkled; petiole slender, 1-2 cm. long, about one-half the length of the blade. Corymbs glabrous, simple or nearly so, 4-8 flowered, 4-5 cm. wide, fruiting pedicels 1-2 cm. long; calyx broadly conical, the short 3-5 mm. long entire lobes narrowly triangular; stamens 20, 5 mm. long; fruit globose, glabrous, 9-14 mm. thick, dull red or reddish when ripe, and capped by the persistent calyx lobes, pruinose; seed 5-6 mm. long, the lateral faces plane.

Roadsides and old fields, Ashe and Watauga counties, North Carolina, and northward.

CRATAEGUS ARENICOLA sp. nov. A slender tree, with few irregular branches, or generally a shrub. Twig of the season slender, chesnut brown, villous with short coarse grey hairs; thorns very slender, 3-4 cm. long, generally grey. Leaves thin but firm, dark green, lucid and rough above, much paler, dull and rough pubescent beneath, ovate, obovate, or spathulate, 2-5 cm. long, 1.5-3 cm. wide, obtuse or rounded at the apex, dentate, except

at the entire base where narrowed into the short, 5 mm. long, margined petiole. Corymbs simple, 1-5 flowered, pedicels erect, villous, 3-7 mm. long; calyx pubescent, stalked and persistent on the fruit, the lobes lanceolate, 6 mm. long, laciniate, persistent; petals white, nearly orbicular, about 7 mm. long; stamens 20, barely 2 mm. long. Fruit pyriform, 12 mm. long, 8-10 mm. wide, villous when young, at length glabrate, orange, or red-cheeked when ripe; falling in October before the leaves.

Type locality, Jessup, Moore county, N. C. *Crataegus arenicola* is not uncommon throughout the coastal plain. It is related to *C Raleighensis*, from which it is separated by the differently shaped crenate leaves, and more pyriform, shorter pedicelled fruit.

CRATAEGUS BREVIPEDICELLATA sp. nov. A small tree 2-4 m. in height, with an open crown of a few short spreading branches. Twigs slender, glabrous, geniculate, those of the season a bright glossy red or purple brown; thorns slender, 3-4 cm. long, usually straight. Leaves thick, firm, yellowish green, rather dull, the blades obovate or nearly orbicular in outline, 2-4 cm. long, 1.5-4 cm. wide, finely and obtusely glandular serrate, occasionally with 3-5 shallow lobes, obtuse, rounded or acute at apex, narrowed at the acute or rounded base into a stout margined glandular roughened petiole, about 1 cm. long. Corymb simple, 3-6-flowered, pedicels glabrous, rather slender, 7-13 mm. long while in flower, with one or two early caducous, glandular, margined viscid bractlets; calyx deeply conical, stalked on the fruit and at length generally deciduous, the lobes oblong, glandular serrate; stamens 10. Fruit glabrous, orange red or dull red, the flesh orange; seed 4-5, the lateral faces plane.

Type locality, near Priest Hill, Moore county, N. C.

CRATAEGUS CATAWBIENSIS sp. nov. A small tree

4-6 m. in height, with an oval crown, and spreading or ascending branches. Twigs very slender, glabrous, sparingly armed with stout thorns 3-5 cm. long. Leaves glabrous, thin but firm, dark green above, paler beneath, the blades ovate or broadly ovate 3-6 cm. long, 2.5-5 cm. wide, sharply and coarsely serrate, and with a few shallow lobes, acute at apex, rounded or truncate at base; petiole 1.6-3 cm. long, about one-half the length of the blades. Corymbs glabrous, compound, generally becoming simple in fruit, 4-6 cm. wide, 3-7-flowered. Fruit obovate or nearly globular, 13-16 mm. long, 12-15 mm. thick, dull dark red when ripe, mottled with green or orange, maturing early in October and persistent until after the leaves fall; pedicels 1-1.6 cm. long, ascending or spreading; calyx nearly sessile on the fruit, the short triangular lobes spreading; stamens 20; seed generally 5, apical, 7-8 mm. long, lateral faces plane, 4-5 mm. wide, dorsal furrows shallow; flesh firm and juicy, whitish.

Headwaters of the Catawba river. Type material from near Round Knob, McDowell county, N. C.

CRATAEGUS MULTISPINA sp. nov. A small tree 2-4 m. in height, with numerous horizontal straight branches, which form a flattened or globular crown, and dense foliage. Twigs slender, glabrous, brown-purple, armed with numerous thorns, 2.5-4 cm. long. Leaves glabrous, coriaceous, lucid, firm, bright green above, paler beneath, spathulate, 2.5-4.5 cm. long, 7-16 mm. wide, rounded at apex, gradually tapering below into a short petiole or sessile, denticulate above, entire below the middle. Corymbes glabrous, very compound, 5-8 cm. wide, 10-20-flowered; flowers small, about 1.5 cm. wide; stamens 5-10; calyx lobes very narrowly triangular, acute, entire, sessile and persistent on the mature fruit. Fruit oblong, 9-12 mm. long, 7-9 mm. thick, dull red brown when ripe, in large clusters, on slender drooping pedicels 7-20 mm. long; seed generally 5, small, the lateral faces plane.

Dry hillsides, McDowell county, N. C., between 400 and 900 m. altitude. The type material from Round Knob, below Swannanoa Gap, is preserved in my herbarium. This species is very much like *Crataegus crus-galli*, but both leaves and fruit are much smaller, and the foliage is a darker green.

CRATAEGUS SCHNECKI sp. nov. A small tree, with drooping branches. Twigs very slender, purplish or brown-purple. Leaf-blades 3-7 cm. long, 2-6 cm. wide, ovate, broadly ovate or nearly orbicular in outline, thin and glabrous, bright green, truncate, obtuse or rounded at base, sharply serrate; petioles slender, winged above, 1-4 cm. long. Inflorescence wide-spreading, nearly simple, 4-8 flowered; stamens 20; styles 4-5; fruit nearly globular, about 8 cm. thick, bright red when mature, sparingly glaucous, tipped by the persistent greenish calyx-lobes which are acute and entire; pedicels 2.5-4 cm. long, slender, glabrous.

Collected at Lawrenceville, Ill., in 1895, by Dr. J. Schneck, with whose name I am pleased to associate the species.

CRATAEGUS HAEMACARPA sp. nov. A tree 5-8 m. in height, with numerous long ascending branches forming an oblong or oval crown, the short branchlets racemose along the branches. Twigs glabrous, slender, armed with numerous slender, 3-4 cm. long, dark purple-brown thorns. Leaves thin but firm, glabrous, erect or ascending on strict petioles, persistent until late in autumn and coloring a brilliant scarlet; the blades broadly ovate or deltoid, 2.5-5 cm. long, 2.5-6 cm. wide, rounded, truncate or on vigorous shoots cordate at the serrate base, sharply and rather coarsely serrate or doubly serrate, on vigorous shoots 3-5 lobed; petioles 1.5-2.5 cm. long, very narrowly margined, sometimes ronghened with a few dark glands. Inflorescence a 4-11-

flowered, nearly simple corymb, 3-6 cm. wide; stamens 20. Fruit in simple 2-5-rayed cymes, on slender, 2-3 cm. long, ascending or spreading pedicels, depressed pyriform, generally much broader than long, 8-12 mm. long, 10-14 thick, angled by the nutlets, glabrous, very dark purple, olivaceous or at length bright crimson, pruinose, ripening late in October and persistent until late in winter after the foliage has fallen, capped by the sessile calyx, its narrowly triangular lobes erect and coloring with the fruit; flesh firm, juicy, becoming blood-red as the fruit colors; nutlets 3-4, small, 5 mm. long, the lateral faces plane, very deeply sulcate and ribbed on the back, placed nearly central in the fruit.

The type material is from the banks of the Cullassagee river, Macon county, N. C., where the species is very abundant. This tree is evidently closely related to *Crataegus macrosperma*, from which it is separated by the smaller nutlets, and smaller and differently shaped fruit, which persists after the fall of the foliage.

CRATAEGUS FLAVO-CARNIS sp. nov. A slender tree 3-5 m. in height, with short intricate branches forming an oblong crown, the bark of the trunk nearly black, cross-checked, as of the black haw, that of the branches dark gray. Twigs slender, glabrous, purple-brown, armed with numerous, 3-4 cm. long stout thorns. Leaves glabrous, thick and firm, very dark green above, pale beneath, the blades 3-5 cm. long, 2-4 cm. wide, ovate, obovate or nearly orbicular in outline, acute or obtuse at the apex, rounded or cuneate at the serrulate base, obtusely serrate; petiole 6-2 cm. long, margined above, and roughened by 1-3 pairs of dark brown glands. Inflorescence a usually simple corymb, glabrous, 3-6 cm. wide, 3-8-flowered; pedicels ascending (even in fruit), 1-1.8 cm. long; stamens 10; calyx-lobes large, oblong glandular serrate, Fruit globular, 12-14 mm. thick, somewhat angled by the

nutlets, bright red or orange-red when ripe in October, capped by the short-stalked calyx, its lobes spreading; flesh orange-yellow; nutlets apical, 4-5, 6-7 mm. long, deeply furrowed dorsaly, the lateral faces plane.

Type material from near Salisbury, N. C. This species is related to *C. rotundifolia*, from which it is easily separated by the shape and texture of the leaves and the different fruit.

CRATAEGUS PEARSONI sp. nov. A small tree 5-8 m. in height with dark brown or blackish rough bark, and tortuous branches forming an oval crown. Twigs flexuous or geniculate, slender, at first canescent, at length glabrous and glossy red-brown, armed with numerous stout, short, thorns. Leaves, when young, more or less canescent on both sides, at length nearly glabrous, spathulate or obovate, 3-6 cm. long, rounded at the apex, cuneate at the base, the margins glandular-crenate and often 3-5 notched at the apex; petiole 1-2 cm. long, glandular roughened. Inflorescence cymose, 3-7-flowered, 5-6 cm. wide, pedicels 2-3 cm. long, canescent, at length glabrate; flowers 2-2.5 cm. wide; stamens 20; calyx-lobes very long, 6-8 cm. long, ligulate, serrate at the end. Fruit oblong, 11-16 mm. long, dark red when ripe, and capped by the nearly sessile calyx; cavity 6-7 mm. wide; flesh orange; nutlets 4-5, 7-8 mm. long, attenuate at base, lateral faces plane, dorsal surface nearly smooth.

Type material from Kings Mountain, N. C. Related to *Crataegus elliptica*, from which separated by having larger fruit and differently shaped foliage. Named for Prof. Gilbert Pearson, of Guilford College, N. C.

CRATAEGUS CULLASAGENSIS sp. nov. A small tree 4-8 m. in height with dark brown or blackish bark broken into small rectangular ssales, and long spreading or drooping branches forming an oval crown. Twigs slender, flexuous or nearly straight, glossy purple-brown,

when young sparingly pubescent, armed with numerous stout 3-4 cm. long thorns. Leaves thin but firm, bright green, glabrous above, at length glabrous below, with 3-4 pairs of prominent veins, the blades ovate rhombic or obovate, 2.5-5 cm. long, 1.5-4 cm. wide, cuneate at base, obtuse or rounded at apex, 3-5 notched above the middle, glandular denticulate; petiole 5-2.5 cm. long, narrowly margined or winged above by the decurrent blade, roughened by numerous sessile dark brown glands. Inflorescence in nearly simple corymbs, sparingly pubescent, at length glabrate, 3-7-flowered, 4-6 cm. wide: calyx-lobes narrowly triangular or ligulate, 5-7 mm. long, glandular-serrate, persistent on the fruit: stamens 20, very slender. Fruit glabular or slightly oblong, 12-16 mm. thick, soon glabrous, dark orange mottled with orange-red and crimson, persistent after ripening on ascending or spreading pedicels until after the leaves have fallen, capped by the persistent stalked calyx; the 5 mm. wide cavity obconic; flesh orange, firm and dry, very sweet; nutlets 4-2, 6-7 mm. long, the lateral faces plane, the back nearly smooth.

The type material is from hills along the Cullasagee river, Macon county, N. C. This species is related to *C. Michauxi* and also to *C. flava*. It is separated from *C. Michauxi* by having much larger fruit and smaller leaves; and from *C. flava* by having thinner, more pointed leaves and geniculate twigs.

CRATAEGUS RIPARIA sp. nov.. A small tree 4-10 m. in height with dark bark broken into small thin scales, and spreading or ascending branches which form a dense oval crown. Twigs glabrous, somewhat flexuous on vigorous shoots. Leaves thin, glabrous, the blades ovate or deltoid, or nearly orbicular, 4-7 cm. long, 3-6 cm. wide truncate or rounded at base, abruptly acute at apex, sharply serrate, 7-9-notched; petiole slender, 2-3 cm.

long. Flowers in 5-10-flowered compound glabrous, 4-6 cm. wide, corymbs; stamens 10. Fruit globular 14-17 mm. thick, bright orange-red or darker, capped by the very closely sessile calyx, the lobes erect; flesh yellow; nutlets 7-8 mm. long, prominently ridged dorsally, lateral faces plane; fruiting pedicles 5-13 mm. long, spreading or declined.

Type material from Swain county, N. C., where the species is very common along the Oconaluftee river.

CRATAEGUS DURIFOLIA sp. nov. A small tree 4-6m. in height with slender glabrous red-brown twigs sparingly armed with 3-4 cm. long thorns. Leaves glabrous, thin, but firm, dark green above, paler and sparingly glaucous beneath, the blades rhombic or rhombic ovate in outline, 3-7cm. long, 2.5-6 cm. wide, with 2-4 pairs of prominent veins, finely and sharply serrate or doubly serrate or with 3-7 shallow lobes, acute at apex, cuneate or rounded at base; pedicels slender, more than one-half the length of the blades. Inflorescence cymose, 3-6 cm. wide, 3-8-flowered, glabrous; stamens 20; calyx-lobes stalked on the fruit, usually deciduous before it ripens; calyx-lobes narrowly triangular; the cavity 4-5mm wide. Fruit 8-10 mm. thick, globular, glabrous, dull red, persisting until after the foliage falls.

Alluvial lands on streams Missouri and Illinois. The type material is from Missouri. This species is closely related to *Crataegus Schnecki*, from which it is separated by having smaller fruit and smaller and differently shaped foliage.

CRATAEGUS GATTINGERI sp. nov. Twigs glabrous, dark purple-brown, sparingly glaucous, armed with numerous thorns 3-4 cm. long. Leaves glabrous, dark green above, paler beneath, the blades oblong, ovate or deltoid in outline, 2-7 cm. long, 2-5 cm. wide, rounded, truncate or subcordate at the base, attenuate at the apex.

finely, but acuminately serrate, generally with 3-5 prominent lobes;petiole slender, roughened above with 1-2 pairs of glands. Corymbs few-flowered, the pedicels slender and glabrous, 1-1.5 cm. long; calyx-lobes short, triangular, glabrous; stamens 20. Fruit dark red, sparingly pruinose, globular, 8-11 mm. thick, generally capped by the stalked, calyx-lobes persistent until after the foliage has fallen.

This species is probably nearest related to *Crataegus erythrocarpa* of the Atlantic coast, from which it is separated by the entirely different foliage and somewhat larger and more fleshy fruit. The type locality is Nashville, Tennessee, where the species was collected by Dr. Gattinger in September ,1880.

CRATAEGUS PALUSTRIS sp. nov. A small tree 5-8 m. in height. Twigs slender, glabrous, dark purple, at first sparingly glaucous. Leaf-blades ovate,4-8 cm. wide, rounded, truncate or subcordate at base, acute at apex, finely and obtusely serrate, or doubly serrate, more or or less 5-9 lobed, glabrous, firm and thick, dark green above, very pale beneath; petiole slender, 1-3 cm. long. Corymbs nearly simple,3-5 cm. wide,glabrous 4-8 flowered; stamens 20; styles 4-5; calyx-lobes stalked,in fruit generally deciduous,the lobes very broad; the cavity 4-5 mm. wide, very shallow. Fruit glabrous, 9-14 mm. thick, nearly glabular,dark red; pedicels 1.5-3 cm. long.

Type material collected by the writer in a small alluvial swamp near Freeport. Indiana.

CRATAEGUS CILIATA sp. nov. A small tree 4-7 m. in height, with an oval crown of spreading or ascending branches. Twigs, glossy brown-purple, sparingly glaucous, when young somewhat villous, at length glabrate, armed with very slender dark purple thorns, 5-7 cm. long, or occasionally much shorter. Leaves dark green and scabrous above, paler beneath, more or less pubes-

sent along the prominent veins, the blades ovate or broadly ovate in outline, 3-5 cm. long, 2-3.5 cm. wide, acute at the apex, rounded, obtuse or truncate at the base, acuminately serrate except at the entire base, often with 3-7 shallow lobes; petiole slender, 1.2-2.5 cm. long, pubescent with spreading hairs or ciliate on the lower side. Inflorescence cymose, 3.5-5 cm. wide, 4-7-flowered, the flowers appearing when the leaves are nearly fully grown; floral bractlets filiform, not conspicuous; pedicels 1-2.3 cm. long, at first sparingly pubescent, at length glabrate, strict; calyx ovate, the entire lobes broad and foliaceous; stamens 20. Fruit 9-12 mm. long, 8-11 mm. thick, dull red when ripe, sparingly pruinose, capped by the sessile calyx-lobes, the cavity 4-5 mm. wide, very shallow.

Dry hills, middle North Carolina to Pennsylvania. The type material is from Raleigh, N. C.

CRATAEGUS DISPERMA sp. nov. A slender tree 5-8 m. in height with gray or blackish scaly bark beset with numerous simple or compound thorns and fastigate branches forming an oval or obovate crown. Twigs slender, glabrous, dull brown or glossy red-brown, armed with numerous slender slightly curved 3-4 cm. long thorns. Leaves glabrous dark green, and glossy above, dull and much paler beneath; the blades ovate, elliptic or obovate, 4-7cm.long, 3-5 cm. wide, obtusely serrate, sparingly and irregularly lobed, obtuse or abruptly acute at apex, rounded or acutely narrowed at base into the short .6-2.5 cm. long margined petiole. The flowers appear when the leaves are about half grown, in nearly simple 3-8-flowered corymbs, the short pedicels with 1-2 linear or oblong bright purple pectinately glandular caducous bractlets. Flowers white, 2 cm. wide; stamens 10, 6-8 mm. long; styles usually 2, slender, 5 mm. long; calyx obconic, the narrowly triangular divisions geneariy entire. Fruit oblong,12-14 mm. long,9-11 mm.thick,bright

but dark red, mottled with green, the calyx-lobes nearly sessile, the persistent lobes spreading; fruiting pedicels erect or ascending, .6-1.8 cm. long; seed usually 2, apical, 6-7 mm. long, dorsal grooves shallow, the lateral faces plane.

Pennsylvania and New York westward to Illinois. Type material from Wilkesbarre Mountian, Penn.

CRATAEGUS EGANI sp. nov. A small tree with spreading branches. Twigs slender, glabrous, armed with rather few short 2-4 cm. long thorns. Leaves glabrous, dark green above, paler beneath, the blades ovate in outline, 3-6 cm. long, 2-5 cm. wide, acuminate or abruptly acute at apex, rounded or obtuse at base, with 4-6 pairs of prominent parallel veins, sharply and finely serrate or doubly serrate all around, generally 5-9-notched; petioles slender, 2-3 cm. long. Infloresence in glabrous compound 4-7cm. wide, many flowered corymbs; flowers about 2 cm. wide; calyx-lobes 5-6 mm. long, narrowly triangular. Fruit bright red, glabrous, oblong; 12-16 mm. long, 8-13 mm. thick, capped by the sessile calyx-lobes, maturing about the middle of October, and persistent until after the leaves have fallen, in usually compound clusters, the 1-3 cm. long pedicels drooping; nutlets 3-4, small, 4-6 mm. long, the lateral faces 3 mm. wide, plane, the back smooth or with shallow furrows.

The type material, from northern Illinois, is preserved in my herbarium. *Crataegus Egani* is evidently related to *Crataegus Holmesiana* from which it is separated by having smaller foliage and fruit, and smaller nutlets. This species is named for Mr. W. C. Egan, of Chicago, Ill.

CRATAEGUS CUTHBERTI sp. nov. A small tree 3-5 m. in height with an open crown of few long tortuous spreading or pendant branches. Twigs rather stout, villous, at least when young, dull gray or brownish, geniculate, armed with stout 4-6 cm. long thorns. Leaves

dark green, thick, villous beneath with soft matted gray pubesence,at least when young, spathulate to orbicular in outline, 2-5 cm. long, .6-2 cm. wide, rounded, obtuse or acute at the apex, often 3-5-notched above, cuneate at base, the margin glandular-denticulate or serrate; sessile or with a short glandular petiole. The 10-13 mm. wide flowers appear when the leaves are nearly fully grown in 2-5-flowered cymes; calyx-lobes very narrow, villous, denticulate; stamens 20; pedicels strict in fruit, villous. Fruit globular or pyriform, 9-12 mm. thick, dull red, capped by the base of the stalked calyx,the cavity short-cylindrous, very villous at base; flesh orange; nutlets 4-5, lateral faces plane, the back nearly smooth,somewhat attenuate at the base.

Dry sandy soils, eastern North Carolina and southward. Type material from Bladen county, N. C. Named for Mr. A. Cuthbert, of Augusta, Ga.

CRATAEGUS GENICULATA sp. nov. A shrub less than one meter in height, or occasionally a very small tree 3-4 m. in height with long tortuous branches, the lower drooping, and rimose black bark. Twigs very slender, geniculate or flexuous, the internodes very short, at first pubescent with rough gray hairs, at length glabrate and brown-purple, armed with very slender gray or purple thorns 1.5-3 cm. long. Leaves at first more or less gray pubescent (especially their petioles, and those on vigorous shoots), at length glabrate, bright green on both sides, spathulate or obovate, 1-3.5cm. long, .5-cm. 2 wide,rounded or obtuse at the apex,cuneate at the entire base, glandular denticulate or serrate, often with 3-5 notches above (or on vigorous shoots nearly orbicular, and the margins acuminately glandular serrate); petioles very short and glandular roughened, or the leaves are sessile. Flowers 1-3 together, pedicels .5-1.5 cm. long, erect, villous, at length glabrate; calyx obconic, villous,

the narrow lobes glandular denticulate; stamens 20. Fruit pyriform, 8-14 mm. long, 7-12 mm. thick, lemon-yellow, orange or mottled with red, capped by the persistent short-stalked calyx-lobes, falling with the leaves about the middle of October, or shortly after; flesh orange, dry and firm; nutlets 4-5,5-6 mm. long, attenuate at the base, the back smooth or nearly so, lateral faces plane.

Dry hills, middle North Carolina. While closely related to *Crataegus Michauxi* the above species is at once separated from it by its smaller size, smaller foliage and more simple inflorescence.

CRATAEGUS YADKINENSIS sp. nov. A small tree 4-10 m. in height with numerous branches forming an oval or round crown and dense foliage. Twigs straight or somewhat flexuous, armed with few slender 3-4 cm. long thorns, at first villous, at length usually glabrate and bright brown-purple. Leaves obovate or spathulate, the blades 1.5-3cm. long, rounded at the apex, the base cuneate, glandular denticulate, except at the entire base, 2-3 pairs of prominent divergent veins, when young pubescent, at least on the veins, and glandular-viscid, (on vigorous shoots nearly orbicular, sparingly lobed, and rounded or truncate at base, often permanently pubescent); petiole 3-10 mm. long, pubescent, glandular dotted. Corymbs nearly simple, 2.5-3.5 cm. wide, 5-10 flowered; flowers 13-15 mm. wide, appearing when the leaves are nearly fully grown; stamens 20; fruit pyriform or subglobose, 7-11 mm. thick, tipped by the stalked calyx-lobes, dull red or orange when ripe in September.

The type material is from Rowan County, N. C. from the hills along the Yadkin river.

ON THE ADIE AND WOOD METHOD FOR THE DETERMINATION OF POTASSIUM.*

CHARLES BASKERVILLE AND ISAAC F. HARRIS.

The American Agricultural Chemists through their official organization have done most valuable work in improving, standardizing and shortening the methods for analysis of the products of husbandry. Refined and abbreviated volumetric methods are in use for nitrogen and phosphoric acid. Attention has been directed toward the shortening of the method for potash by the use of Gladding's solution and variations in detail.

The method of Adie and Wood (*J. L. Chem. Soc.* 77; 1078) founded upon the observations of Erdmann (*J. pr. Chem.* 77; 385) and Sadtler (*Amer. J. Sci.* 49; 189), namely, the formation of an insoluble double sodium and potassium cobaltinitrite, $[K_2NaCo(NO_2)_6,H_2O]$ promises an ideal and most satisfactory gravimetric and volumetric process. We have tested it in this laboratory on a commercial muriate with very good results:—

	Official Method.	Adie and Wood Method.
Potash found	48.63 per cent.	49.02 per cent.
		48.72 " "

Full details of the method are to be found in the original article (*loc. cit.*). The advantages of the method carried out according to the specific directions may be summed up as follows:--precipitation directly from the filtered digestion of the fertilizer or soil; avoidance of the use of expensive platinic chloride; the precipitant, sodium cobaltinitrite, is easily prepared and and keeps well; great saving of time, as determination can be made within two hours.

*Read at the Fall Meeting of the N. C. Section of the American Chemical Society. Nov. 9th. 1900.

RICHTER AND THE PERIODIC SYSTEM.

F. P. VENABLE.

A very remarkable work appeared at the close of the last century. This was 'Die Anfangs-gründe der Stöchyometrie', by J. B. Richter, the first volume of which appeared in 1792, and the third and last volume in 1794. In this book we have the first definite statement of the law of proportionality, and some have thought that they have found in it also the Atomic Theory, though it is not claimed that this theory was definitely stated.

Richter's work attracted much attention at the time because of his defense in it of the phlogistic theory and it was vigorously attacked by the supporters of the New Chemistry, who followed Lavoisier and the French chemists. The deeper purport of the book and the new ideas advanced do not seem to have been well understood or to have been largely commented upon. Fischer, who in 1802 translated into German Berthollet's 'Statique Chimique,' was apparently the first to draw general attention to the work of Richter and to its bearing upon the conclusions drawn by Berthollet. This latter chemist and Guyton de Morveau acknowledged that Richter had anticipated them in the inference to be drawn from the permanence of neutrality after the decomposition of certain neutral salts and the possibility of calculating beforehand the composition of the salts produced. The discovery of the law of proportionality was a most important one and Richter must, therefore, be regarded as a very remarkable man. In his discovery that the amounts of different metals combining with a given weight of acid combine with a fixed amount of oxygen, he went a step further, anticipating the work of Gay Lussac, and when

he established the fact that such metals as iron and mercury have the power of combining with oxygen in several proportions, showing different degrees of oxidation, he was several years ahead of Proust and verged upon the discovery of the law of multiple proportions.

With all of his ability to see deeply into the workings of natural phenomena Richter was not a clear and logical thinker. Wurtz rightly speaks of him as 'the profound but perplexed author of the great discovery of proportionality.' He was confused by his adherence to the illogical phlogistic theories which were becoming each year more untenable. He was further hampered by his determination to give a mathematical foundation to the science of chemistry and to express all chemical changes by formulae and equations worked out along algebraic lines. It was doubtless, the presence of these mathematical equations all through his volumes which deterred many chemists from a full and patient examination of them for the kernel of truth which they might contain. The average experimental chemist is not much attracted by abstruse mathematical speculations.

Later chemists commenting upon his work have made some mention of the mathematical regularities observed by him and this led me to think that perhaps Richter might have caught some glimpse of the periodic law before the conception of the atom and the atomic theory had entered into chemistry. To investigate this question it was necessry to examine Richter's writings and I was fortunate enough to secure the use of a copy of his Stöchyometrie through the courtesy of the librarian of the American Academy of Arts and Sciences.

It is of interest, first, to see how near an approach Richter made to the conception of atoms. In the preface to volume I the question of solution is discussed and the statement is made that "the chemist cannot boast of

being able in any manner to divide a body up into the smallest parts because matter can be thought of as infinitely divisible." From many passages one may judge, however, that he held to the corpusclar view of matter, namely that it was composed of certain very small, discrete particles, which were, however, conceivably further divisible. Thus in giving the various definitions of elements he says that to one chemist the word meant the simplest indestructible substance, the subtlest material which the creator had created for the formation of all other bodies; to another it meant such materials as could not be decomposed into dissimlar particles and in which no component particles could be recognized. For himself he prefers to divorce the word from all connection with primal matter, or Urstoffe, and to make use of it simply as a part of the chemical technology, attaching to it the meaning of a body undecomposable by any means known to the chemists. Chemistry as an art, according to Richter, consisted in the ability to separate elements from one another and to bring them together as constituents of a new body. Chemistry as a science was something greater, including its theories and fundamentl axioms. A chemical element, he says, is one which, without being decomposed into unlike parts, can by mixing with other kinds of matter cloak their peculiar characteristics and bring about others. It is *elementuum immediatum* when it cann t be decomposed into unlike parts: *mediatum* when it can be thus decomposed (p. 5 seq.).

Thus, as Richter adds in a footnote, vitriolic acid is an *elementum immediatum* since no one has been able to decompose it into unlike parts, but sulphur is an *elementum mediatum* since anyone knows that it can be decomposed into vitriolic acid and phlogiston and reformed from these two. This is of interest as showing the degree of

knowledge on which he based his reasoning. His corpuscles are called 'Theilganzen,' and in these the force of affinity resides. Thus he states, "to each infinitely small particle of the mass of an element there belongs an infinitely small portion of the chemically-attracting force of affinity" (p. 123).

The part of Richter's work which appears to refer most nearly to the periodic system is found is his second volume on page VI of the preface. He refers to the fact that the supposition had already been made in a paper on the 'Newer Objects of Chemistry, especially the recdiscovered half-metal Uranium,' that the affinities of many chemical elements towards any single one might be in a definite progression. The supposition, says Richter, has already in the case of four quantitative series been raised to the dignity of an incontrovertible rule. The tables of masses form arithmetical progressions and the affinities of the elements which belong to the series, proceed also, in so far as they are not disturbed by the indwelling elementary fire, in the order of the masses. Besides one is in position to see the probability of many homogeneous elements present in nature. Also the double affinities proceed in arithmetical progression and "with careful observations one can scarce resist the thought that *the entire chemical system consists of similar progressions.*"

It is well to examine a series given by Richter to get more fully at his meaning. Thus in the same volume, page 28, he gives the masses of the alkaline earths which neutralize 1,000 parts of hydrochloric acid.

Magnesia $734=a$
Lime $858=a+b\ (734+124\frac{1}{2}=858\frac{1}{2})$
Alumina $1,107=a+3b\ (734+3\times124\frac{1}{2}=1,107\frac{1}{2})$
$=a+5b(734+5\times124\frac{1}{2}=1,356\frac{1}{2})$
$=a+7b(734+5\times124\frac{1}{2}=1,605\frac{1}{2})$, etc.
Baryta $3,099=a+19b(734+19\times124\frac{1}{2}=3,099\frac{1}{2})$

Similar series are given for the alkalies and alkaline earths with the different acids. Again these tables are compared with one another and thus was brought out the law of proportionality. One of the most remarkable regularities is gotten by examining the differences in the masses in such a series made up of observed combining numbers of known elements and interpolated combining numbers of hypothetical elements. Thus (p. 38):

616—526=90 =1×90
796—529=376=3×90
973—526=347=5×90—3
1,152—526=626=7×90—4
1,330—526=804=9×90—6
erc., etc.

Of course, it is readily seen that all these regularities are more in the line of the triads of Döbereiner or the later work of Dumas than the periodic system. But a close examination reveals something more—a really deeper insight into the nature of the elements which is marellous when one considers that Richter was dealing with compounds not elements, and with combining numbers and not atomic weights. First one must note his statement of the belief that 'the entire chemical system consists of like progressions.' To his mind the elements formed a system correlated and made up of p ogressions. This is, of course, not the ascending series of de Chancourtois and Newlands, but it seems to me a position much nearer to it than was reached by any chemist for more than half a century afterwards.

Again, in other portions of this volume Richter speaks of the necessity of deducing quality from quantity and vice versa. Thus he points out that the series of masses mentioned as forming arithmetical progressions are really series of affinities also, and the relative affinities might be deduced from the relative masses. Much space is also

given to the effort at tracing relationships of specific gravities. While it cannot be positively stated that Richter foresaw that important part of the periodic law that the properties of the elements are dependent upon the relative weights, he seems at least to have been possessed with the idea that what he called the masses of the elements had something to with what he considered the qualities, or that they progressed similarly. And that they in the main progress similarly is about all we know with regard to them at the present day

I acknowledge that there is some difficulty in sifting out Richter's full meaning from the mass of mathematical calculation and one must be careful to avoid reading into his work the thought of later years. It is not strange that thetedium of following such involved calculations and speculations as his should have deterred his contemporaries from following his trend of thought or paying much attention to him. It cannot be claimed that he preceded Dalton in his conception of the Atomic Theory but Richter belongs to the number of the great original thinkers of chemistry and it is time that greater justice be done him.